IN THE UNITED STATED DISTRICT COURT
FOR THE WESTERN DISTRICT OF TEXAS
WACO DIVISION

MONUMENT PEAK VENTURES, LLC,	§	
	§	
Plaintiff,	§	
	§	
v.	§	Case No. 6:21-cv-00379
	§	
TOMTOM NORTH AMERICA INC., and TOMTOM INTERNATIONAL BV,	§	JURY DEMANDED
	§	
	§	
Defendants.	§	

PLAINTIFF'S ORIGINAL COMPLAINT

Monument Peak Ventures, LLC ("MPV" or "Plaintiff"), by and through the undersigned counsel, hereby brings this action and makes the following allegations of patent infringement relating to U.S. Patent Nos. 6,282,317 (the "'317 Patent"), 7,035,461 (the "'461 Patent"), 7,680,340 (the "'340 Patent"), and 7,860,320 (the "'320 Patent") (collectively the "Asserted Patents") against Defendants TomTom International BV ("TomTom International") and TomTom North America Inc. ("TomTom NA") (collectively, "Defendants") and as follows upon actual knowledge with respect to itself and its own acts, and upon information and belief as to all other matters:

I. PARTIES

1. Monument Peak Ventures, LLC ("MPV") is a limited liability company with its principal place of business in Plano, Texas.

2. TomTom North America Inc. is a California corporation with its principal place of business located at 11 Lafayette St. Lebanon, NH 03766. TomTom North America Inc. may be

served with process through its registered agent National Registered Agents, Inc., 1999 Bryan Street, Dallas, TX 75201.

3. TomTom International BV is a Netherlands corporation with its principal place of business located at De Ruyterkade 154, 1011 AC Amsterdam, The Netherlands, TomTom International BV can be served with process at its principal place of business at De Ruyterkade 154, 1011 AC Amsterdam, The Netherlands.

II.
JURISDICTION AND VENUE

4. The Court has federal question jurisdiction under 28 U.S.C. §§ 1331, 1332, 1338, and 1367.

5. Venue is proper under in this Court pursuant to 28 U.S.C. §§ 1391 and 1400(b). Defendants commit acts of infringement within this District and maintain regular and established places of business within the district. Upon information and belief, Defendants commit regular acts of infringement within the District by (a) selling, offering to sell, and importing their infringing products within the District; (b) using their infringing products and perform infringing methods regularly within the District; (c) and making their infringing products through infringing methods and processes within the District.

6. Initially, upon information and belief, Defendants maintains permanent employees within the District, from where they regularly conduct Defendants' regular and established business. Moreover, Defendants own and deploy a fleet of mobile mapping vehicles, which have, and have had, a regular and established presence in major cities throughout this District since at least 2017. The vehicles are operated by Defendants' employees and/or contractors who work entirely at Defendants' direction and under their control. The existence of Defendants' mobile mapping vehicles within this District are steady, uniform, orderly, and methodical such to create,

maintain, and sell Defendants' goods and services (e.g., maps, mapping services, and mapping devices).

7. Both a substantial portion of the value of Defendants' products within the United States and the integrity of their products themselves is dependent upon the regular and established presence of Defendants' mobile mapping vehicles within this District. Indeed, Defendants' place of business is, in fact, inclusive of the major cities within this District. Defendants' products include a representation of major cities throughout this District. Defendants heavily market important components of their map products and services as including detailed diagrams of the roadways and structures within major cities such as Austin, Waco, and San Antonio within this District. Moreover, Defendants' mobile mapping vehicles themselves are highly identifiable with Defendants' branding, "TomTom", on 2-3 sides of the vehicle, and written in large, colorful type-font. Upon information and belief, this branding is specifically intended to draw attention to Defendants' regular presence in this District, the availability of their infringing products for sale within this District, the quality of their infringing product within this district, and the infringing methods used to create and maintain their infringing products.

8. Thus, every aspect of Defendants' product is tied to the major cities within this District. It creates its product in, and using, this District. It sells and markets its product in this District. It has a regular and established presence of employees within this District, for the purpose of creating and marketing its product. Indeed, the presence of those employees is a necessary aspect of the creation and maintenance of its products.

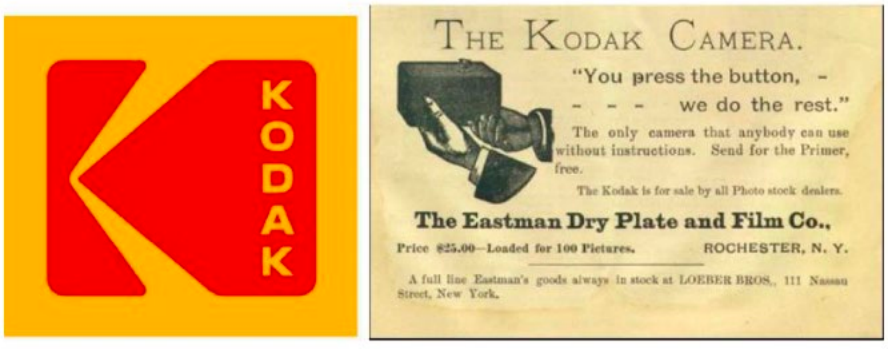
9. Furthermore, venue is proper as to Defendant TomTom International under 28 U.S.C. § 1391(c)(3) and *In re HTC Corp.,* 889 F.3d 1349 (Fed. Cir. 2018) because it is a foreign corporation.

10. This Court has personal jurisdiction over Defendants because they have continuous and systematic business contacts with the State of Texas. Defendants, directly and through subsidiaries or intermediaries (including distributors, retailers, and licensing partners), conduct business extensively throughout Texas, by shipping distributing, making, using, offering for sale, selling, licensing, transmitting (including through its website and mobile applications) its products and services in the state of Texas and the Western District of Texas. Defendants have purposefully placed their products into the stream of commerce with the intention and expectation that they will be purchased and used by consumers in this state and this district. Defendants have used and continue to use and sell their infringing products within this district and have committed regular acts of direct and indirect acts of infringement in this district. Each has a regular and established place of business within the district. Defendants' contacts with the State of Texas and this district are so pervasive such that this Court's exercise of jurisdiction would not offend traditional notions of fair play and substantial justice.

III.
FACTS

11. The Asserted Patents claim inventions born from the ingenuity of the Eastman Kodak Company ("Kodak"), an iconic American imaging technology company that dates back to the late 1800s.

12. The first model of a Kodak camera was released in 1888.



13. In 1935 Kodak introduced "Kodachrome," a color reversal stock for movie and slide film.

14. In 1963 Kodak introduced the Instamatic camera, an easy-to-load point-and-shoot camera.

15. By 1976 Kodak was responsible for 90% of the photographic film and 85% of the cameras sold in the United States.

16. At the peak of its domination of the camera industry, Kodak invented the first self-contained digital camera in 1975.

17. By 1986 Kodak had created the first megapixel sensor that was capable of recording 1,400,000 pixels.

18. While innovating in the digital imaging space Kodak developed an immense patent

portfolio and extensively licensed its technology in the space.

19. In 2010, Kodak received $838,000,000 in patent licensing revenue.

20. As part of a reorganization of its business, Kodak sold many of its patents to some of its biggest names in technology that include Google, Facebook, Amazon, Microsoft, Samsung, Adobe Systems, HTC and others for $525,000,000.

21. While scores of digital imaging companies have paid to license the Kodak patent portfolio owned by MPV, Defendants, without justification, have refused to do so.

A. Nature Of The Action

22. MPV is the owner by assignment of all right, title and interest in and to the ’317 Patent, the ’461 Patent, the ’340 Patent, and the ’320 Patent.

23. This is an action for direct and indirect patent infringement.

24. MPV alleges that Defendants have infringed and continue to infringe, directly and indirectly, the ’317 Patent, the ’461 Patent, the ’340 Patent, and the ’320 Patent.

25. A true and correct copy of the ’317 Patent is attached as Exhibit A to this Complaint.

26. The U.S. Patent and Trademark Office (“USPTO”) granted the ’317 Patent on August 28, 2001, after a full and fair examination.

27. The ’317 Patent is valid and enforceable.

28. A true and correct copy of the ’461 Patent is attached as Exhibit B to this Complaint.

29. The U.S. Patent and Trademark Office (“USPTO”) granted the ’461 Patent on April 25, 2006 after a full and fair examination.

30. The ’461 Patent is valid and enforceable.

31. A true and correct copy of the ’320 Patent is attached as Exhibit C to this Complaint.

32. The U.S. Patent and Trademark Office (“USPTO”) granted the ’320 Patent on

December 28, 2010 after a full and fair examination.

33. The ’320 Patent is valid and enforceable.

34. A true and correct copy of the ’340 Patent is attached as Exhibit D to this Complaint.

35. The U.S. Patent and Trademark Office (“USPTO”) granted the ’340 Patent on March 16, 2010 after a full and fair examination.

36. The ’340 Patent is valid and enforceable.

1. The ’317 Patent

37. The ’317 Patent relates generally to the field of digital image processing and, more particularly, to locating main subjects or regions of interest in a digital image.

38. The ’317 Patent is directed to solving problems particular to automatically detecting the main subjects in digitally captured images.

39. At the time the application for the ’317 Patent was filed, conventional main subject detection methods were, generally, with pixel-based or region-based. The prior art-pixel-based systems and methods were designed to locate interesting pixels, spots, or blocks of a digital image, which usually do not correspond to entities of objects or subjects in an image. The prior art region-based systems and methods were designed to locate interesting regions that correspond to entities of objects or subjects in an image.

40. The prior art pixel-based systems and methods did not explicitly detect regions of interest corresponding to semantically meaningful subjects in the scene or digital image. Rather, these prior art methods attempted to detect regions where certain changes occur in order to direct attention to gather statistics about the scene.

41. The prior art region-based systems were, in general, directed to target types of

images: video-conferencing or TV news broadcasting images, where the main subject is a talking person against a relatively simple static background; museum images, where there is prominent a prominent main subject centered in the image against a large area of relatively clean background; and tow-world images, where the main subject are a few distinctively colored and shaped objects.

42. The prior art region-based systems were not designed for unconstrained images and the criteria and reasoning processes used were inadequate for unconstrained images, such as photographic images, or images with multiple subjects of interest.

43. The shortcomings in the pixel-based and region-based conventional prior art were solved by the unconventional and inventive methods claimed by the ’317 Patent.

44. Claim 5 of the ’317 Patent covers “[a] method for detecting a main subject in an image, the method comprising the steps of: a) receiving a digital image; b) extracting regions of arbitrary shape and size defined by actual objects from the image; c) extracting for each of the regions at least one structural saliency feature and at least one semantic saliency feature; and, d) integrating the structural saliency feature and the semantic saliency feature using a probabilistic reasoning engine into an estimate of a belief that each region is the main subject, [] wherein step (d) includes using a collection of human opinions to train the reasoning engine to recognize the relative importance of the saliency features.”

45. A person of ordinary skill in the art at the time of the invention would recognize that the steps and methods claimed in at least claim 5 of the ’317 Patent were unconventional and describe extracting and combine both structural and semantic saliency features using a probabilistic reasoning engine into a belief estimate using a collection of human opinions in a way that was not routine.

46. A person of ordinary skill in the art at the time of the invention of the ’317 Patent

would understand that the conventional way of locating a main subject in a digital image involved either the pixel-based approaches of the prior art or the region-based approaches of the prior art. A skilled artisan would recognize that that the conventional pixel-based approaches and region-based approaches presented the problems of not explicitly detecting regions of interest corresponding to semantically meaningful subjects in the scene or digital image (for pixel-based solutions) and were not designed for unconstrained photograph or images with multiple subjects of interest and criteria and reasoning processes used were inadequate for unconstrained images, such as photographic images or images with multiple subjects of interest (for region-based solutions).

47. The ’317 Patent, in at least one embodiment, receives an input image of a natural scene in digital form. That image is segmented into regions of homogeneous properties (i.e. regions of arbitrary shape and size defined by actual objects from the digital image). The regions are evaluated for their saliency using two independent yet complimentary types of saliency features—structural saliency features and semantic saliency features. The structural saliency features, include a set of low-level early vison features and a set of geometric features, are extracted and further processed to generate a set of self-saliency features and a set of relative saliency features. Then, the structural and semantic saliency features are integrated using a probabilistic reasoning engine to yield a belief map of the main subject. This step, in at least one embodiment, uses a Bayes net to integrate the saliency features to yield the belief map. Further, the integration step also includes using a collection of human opinions to train the reasoning engine to recognize the relative importance of the saliency features.

48. A person skilled in the art at the time of the invention of the ’317 Patent would understand that the claims, including at least Claim 5, recited steps operating in an unconventional

manner to achieve an improved method of detecting a main subject in a digital image.

49. These technological improvements provide the advantages of: 1) a robust image segmentation method capable of identifying object regions of arbitrary shapes and sizes, based on physics-motivated adaptive Baysian clustering and non-purposive grouping; 2) emphasis on perceptual grouping capable of organizing regions corresponding to different parts of physically coherent subjects; 3) utilization of non-binary representation of the ground-truth, which captures the inherent uncertainty in determining the belief of main subject, to guide the design of the system; 4) a rigorous systematic statistical training mechanism to determine the relative importance of different features through ground truth collection and contingency table building; 5) extensive, robust feature extraction and evidence collection; 6) combination of structural saliency and semantic saliency, the latter facilitated by explicit identification of key foreground, and background, subject matters; 7) combination of self and relative saliency measure for structural saliency features; and 8) a robust Bayes net-based probabilistic inference engine suitable for integrating incomplete information.

50. The novel use and arrangement of the specific combination and steps recited in at least Claim 5 of the ’317 Patent were not well-understood, routine, or conventional to a person skilled in the relevant field at the time of the inventions. In particular, the order of steps in at least Claim 5 of the ’317 Patent was not well-understood, routine, or conventional to a person of skill in the relevant field at the time of the invention. Similarly, the combination of the steps of at least Claim 5 of the ’317 Patent, particularly the step of integrating the structural saliency feature and the semantic saliency feature using a probabilistic reasoning engine into an estimate of a belief that each region is the main subject, the integration step includes using a collection of human opinions to train the reasoning engine to recognize the relative importance of the saliency features

was not well-understood, routine, or conventional to a person of skill in the relevant field at the time of the invention.

2. The '461 Patent

51. The '461 Patent relates generally to the field of digital image processing and, more particularly, to a method for detecting an object in a digital image.

52. At the time the application for the '461 Patent was filed, conventional object determination techniques, particularly with respect to the detection of redeye in photographs, were dependent on detecting pixels in an image that had the color characteristics of the redeye defect. These conventional techniques relied on detecting candidate redeye pixels based on shape, coloration, and brightness, and in certain circumstances only searching those portions of an image that were skin-colored.

53. The prior art systems/methods did not, however, determine whether the candidate pixels are located in a face or part of a human eye and/or could not detect face regions in their entirety or, more specifically, detect face regions as well separated skin color regions.

54. The shortcomings in the conventional prior art were solved by the unconventional and inventive methods claimed by the '461 Patent.

55. Claim 3 of the '461 Patent covers "[a] method for detecting objects in a digital image, comprising the steps of: a) generating a first segmentation map of the digital image according to a non-object specific criterion; b) generating a second segmentation map of the digital image according to a object specific criterion; and c) detecting objects in the digital image using both the first and second segmentation maps [] further comprising the steps of detecting objects using pattern matching in the first and second segmentations maps respectively and merging the detected objects."

56. A person of ordinary skill in the art at the time of the invention would recognize that the steps and methods claimed in at least claim 3 of the '461 Patent were unconventional and describe detecting objects in a digital image in a way that was not routine.

57. A skilled artisan would recognize that the conventional digital image object detection approaches presented the problems of not being able to fully recognize objects within other relatively homogenous objects. In one embodiment described, this was applied to detecting the object of redeyes within the relatively homogenous object of faces.

58. The '461 Patent, in at least one embodiment, provides technical solutions to these and other deficiencies in the prior art by teaching a method for detecting objects in a digital image, comprising the steps of: a) generating a first segmentation map of the digital image according to a non-object specific criterion; b) generating a second segmentation map of the digital image according to a object specific criterion; and c) detecting objects in the digital image using both the first and second segmentation maps and further comprising the step of detecting objects using pattern matching in the first and second segmentation maps respectively and merging the detected objects.

59. A person skilled in the art at the time of the invention of the '461 Patent would understand that the claims, including at least claim 3, recite steps operating in an unconventional manner to achieve an improved method of detecting objects in a digital image.

60. These technological improvements provide the advantages of: increasing the detection rate of objects in digital images; and for detecting objects within other detected relatively homogenous objects, the detection rate is increased over the prior art method by increasing the correct detection of relatively homogenous object regions in input digital images through the use of multiple segmentation maps.

61. The novel use and arrangement of the specific combinations and steps recited in at least claim 3 of the ’461 Patent were not well-understood, routine, or conventional to a person of skill in the relevant field at the time of the inventions. In particular, the order of steps in at least Claim 3 of the ’461 Patent was not well-understood, routine, or conventional to a person of skill in the relevant field at the time of the inventions. Similarly, the combination of the steps of at least Claim 3 of the ’461 Patent, particularly the step of detecting objects using pattern matching in the first segmentation map (which was generated according to a non-object specific criterion) and a second segmentation map (which was generated according to an object specific criterion) respectively and merging the detected objects, was not well-understood, routine, or conventional to a person of ordinary skill in the relevant field at the time of the inventions.

3. The ’320 Patent

62. The ’320 Patent relates generally to the field of digital image processing and, more particularly, to the classification of image regions within a digital image.

63. The ’320 Patent is directed to solving problems particular to the classification of image regions within a digital image.

64. At the time the application for the ’320 Patent was filed, conventional image region classification methods generally utilized features derived from the image to generate belief maps, e.g., a white region represented snow. Such prior art image region classification methods frequently produced inaccurate results because of the difficulty in deriving features which could accurately distinguish between materials sharing similar color and texture characteristics, e.g., snow versus clouds.

65. Such prior art image region classification methods did not utilize a GPS location captured at substantially the same time as the image as part of a spatial context model to improve

the accuracy of image region classification.

66. The shortcomings in the prior art were solved by the unconventional and inventive methods claimed by the ’320 Patent.

67. Claim 1 of the ’320 Patent covers “[a] method of classifying regions of image pixels in a digital image or video captured by an image capture device comprising: a) providing a geographic location determining device associated with the image capture device that provides an image capture GPS location associated with an image; b) using the location determining device to provide the image capture GPS location at substantially the time that the digital image or video was captured; and c) using a data processor for classifying regions of image pixels in the captured digital image or video into one or more material classes based on a spatial context model that indicates the likelihood that specific material classes occur or co-occur in images or videos captured at the particular image capture GPS location.”

68. A person of ordinary skill in the art at the time of the invention would recognize that the steps and methods claimed in at least claim 1 of the ’320 Patent were unconventional and describe, in a way that was not routine, utilizing image capture GPS location in a model for estimating the likelihood that specific material classes occur or co-occur in an image or video captured at such location.

69. A person of ordinary skill in the art at the time of the invention of the ’320 Patent would understand that the conventional way of performing image region classification would not leverage or otherwise utilize the geographic location of the image. A skilled artisan would recognize that conventional image region classification methods presented the problem of being unable to adequately distinguish between materials sharing similar color and texture characteristics.

70. A person skilled in the art at the time of the invention of the ’320 Patent would understand that the claims, including at least Claim 1, recited steps operating in an unconventional manner to achieve an improved method of classifying image regions within a digital image.

71. These technological improvements provide the advantages of: increasing the accuracy rate of image region classification and utilizing GPS location information as part of a spatial context model for image region classification.

72. The novel use and arrangement of the specific combinations and steps recited in at least claim 1 of the ’320 Patent were not well-understood, routine, or conventional to a person of skill in the relevant field at the time of the inventions. In particular, the order of steps in at least Claim 1 of the ’320 Patent was not well-understood, routine, or conventional to a person of skill in the relevant field at the time of the inventions. Similarly, the combination of the steps of at least Claim 1 of the ’320 Patent, particularly the steps of using the location determining device to provide the image capture GPS location at substantially the time that the digital image or video was captured and using a data processor for classifying regions of image pixels in the captured digital image or video into one or more material classes based on a spatial context model that indicates the likelihood that specific material classes occur or co-occur in images or videos captured at the particular image capture GPS location, was not well-understood, routine, or conventional to a person of ordinary skill in the relevant field at the time of the inventions.

4. The ’340 Patent

73. The ’340 Patent relates generally to the field of digital image processing and, more particularly, to a method of using temporal context to determine the semantic classification of an image.

74. At the time the application for the ’340 Patent was filed, conventional semantic

image classification techniques utilized the low-level content of the image only, e.g., colors, textures, edges.

75. The prior art systems/methods did not, however, leverage the temporal context of the image, i.e., looking at the images temporally adjacent to the image in question to provide additional contextual information for use in image classification.

76. The shortcomings in the conventional prior art were solved by the unconventional and inventive methods claimed by the ’340 Patent.

77. Claim 1 of the ’340 Patent covers “[a] method for improving scene classification of a sequence of digital images comprising the steps of: (a) providing a sequence of images captured in temporal succession, at least two pairs of consecutive images in the sequence of images having different elapsed times between their capture; (b) classifying, with a programmed digital computer, each of the images individually based on information contained in the individual image to generate an initial content-based image classification for each of the images; (c) generating, with a programmed digital computer, a final image classification for each image based at least on the respective initial content-based image classification and a pre-determined temporal context model that considers at least the temporal succession of the sequence of images; and (d) storing the final image classifications in a computer storage medium, wherein the classifying of step (b), and the final image classification classify images into one of a predetermined number of classes M, and wherein M is greater than or equal to two.”

78. A person of ordinary skill in the art at the time of the invention would recognize that the steps and methods claimed in at least claim 1 of the ’340 Patent were unconventional and describe semantically classifying a digital image in a way that was not routine.

79. A skilled artisan would recognize that the conventional semantic image

classification approaches presented the problems of not utilizing temporal context information.

80. A person skilled in the art at the time of the invention of the '340 Patent would understand that the claims, including at least claim 1, recite steps operating in an unconventional manner to semantically classify a digital image utilizing temporal context information.

81. These technological improvements provide the advantages of: increasing the accuracy rate of semantic image classification and utilizing temporal context information as part of a model for the semantic classification of images.

82. The novel use and arrangement of the specific combinations and steps recited in at least claim 1 of the '340 Patent were not well-understood, routine, or conventional to a person of skill in the relevant field at the time of the inventions. In particular, the order of steps in at least Claim 1 of the '340 Patent was not well-understood, routine, or conventional to a person of skill in the relevant field at the time of the inventions. Similarly, the combination of the steps of at least Claim 1 of the '340 Patent, particularly the steps of classifying each of the images individually based on information contained in the individual image to generate an initial content-based image classification for each of the images before then generating a final image classification for each image based on at least the initial content-based image classification and a pre-determined temporal context model that considers at least the temporal succession of the sequence of images.

B. Defendants' Notice of the Asserted Patents and Refusal to License

83. Defendants were first notified concerning their infringement of at least the '320 Patent in June 2018, at which time MPV requested that Defendants take a license to that patent. At that time, Defendants' representative conceded that they understood why their products had initially drawn MPV's attention.

84. At Defendants' request, MPV provided more information concerning Defendants' infringement. In response, rather than defend infringement, Defendants purported confusion as to

their means of infringement. On multiple occasions thereafter, MPV provided Defendants with more detailed information concerning their infringement. In its responsive communications, Defendants conceded that their object identification software employs object and structural specific and salient features (such as sign shape) to identify objects in digital images.

85. Based in part on these concessions, MPV then further notified Defendants of their infringement of the ’317 Patent and the ’461 Patent in May 2019, and of the ’340 Patent in July 2019. MPV continued to communicate with Defendants concerning their infringement of the Asserted Patents through August 2019. Defendants delayed months before responding, and then, without further comment, stated “the matter closed” in February 2020 without further substantive response.

86. Accordingly, upon information and belief, Defendants have full knowledge of their infringement, have fully analyzed the claims of the Asserted Patents, and have yet continued to directly or indirectly infringe at least the ’461, ’340, and ’320 Patents willfully.

IV.
CAUSES OF ACTION
COUNT I: DIRECT INFRINGEMENT OF THE ’317 PATENT

87. MPV realleges and incorporates by reference the allegations set forth above as if set forth verbatim herein.

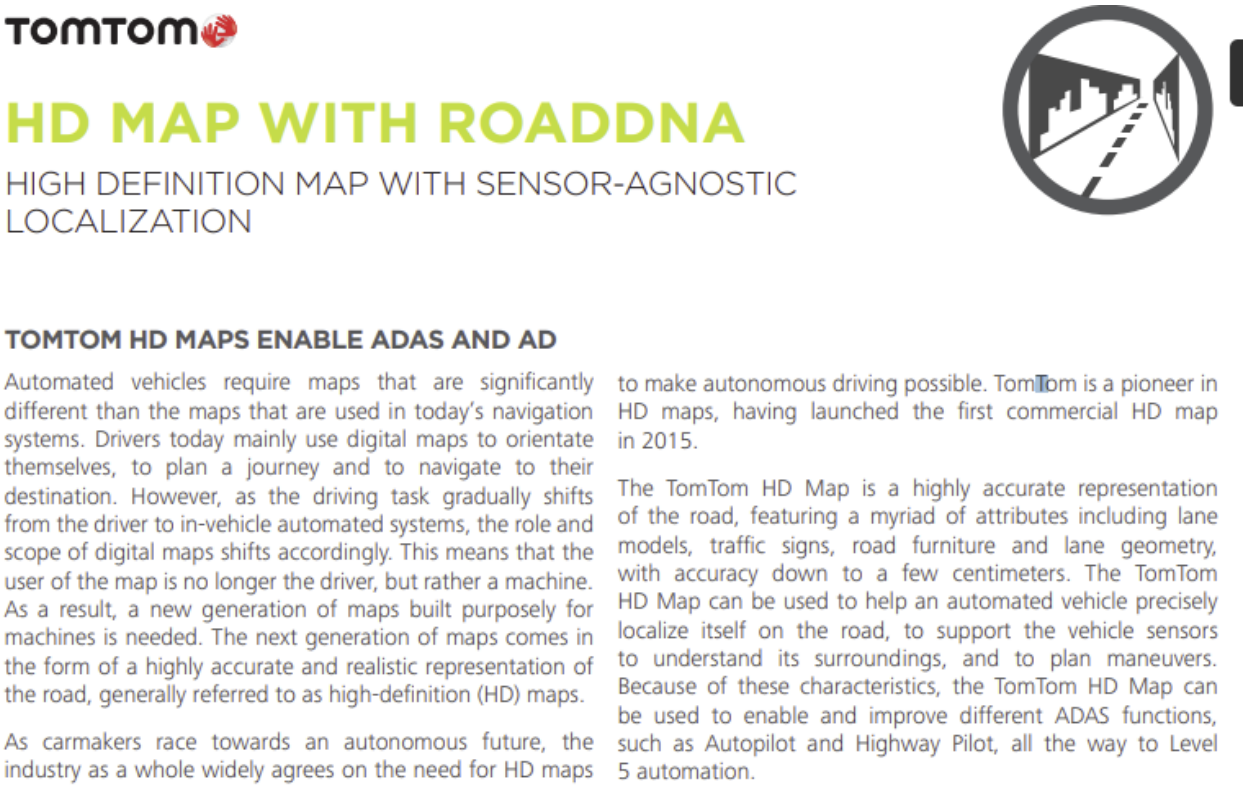
88. MPV owns by assignment the entire right, title, and interest in the ’317 Patent, including the right to sue for past infringement.

89. The ’317 Patent was issued by the United States Patent and Trademark Office on August 28, 2001 and is titled “Method for Automatic Determination of Main Subjects in Photographic Images.” A true and correct copy of the ’317 Patent is attached as Exhibit A.

90. Upon information and belief, Defendants have directly infringed upon at least claim 5 of the ’317 Patent by making, using, testing (including their own use and testing), selling,

offering for sale, importing and/or licensing in the United States without authority products, such as TomTom HD Maps, RoadDNA, and ADAS (collectively, "Accused Products") that were created, generated, manufactured, and updated through infringing methods of automatically determining main subjects of digital images. Defendants offered, sold, imported, licensed and used these products by way of tangible, computer-readable media, such as SSD, DVD, or persistent computer memory.

91. In addition to conventional cartographic information detailing the position and direction of roadways and location of major landmarks, HD maps provided "a highly accurate representation of the road, featur[ing] a myriad of attributes including lane models, traffic signs, road furniture and lane geometry, with accuracy down to a few centimeters." Not only were HD maps deployed for traditional navigation, but they were also suitable for use by in-vehicle automated ("self-driving") systems.



TOMTOM

HD MAP WITH ROADDNA

HIGH DEFINITION MAP WITH SENSOR-AGNOSTIC LOCALIZATION

TOMTOM HD MAPS ENABLE ADAS AND AD

Automated vehicles require maps that are significantly different than the maps that are used in today's navigation systems. Drivers today mainly use digital maps to orientate themselves, to plan a journey and to navigate to their destination. However, as the driving task gradually shifts from the driver to in-vehicle automated systems, the role and scope of digital maps shifts accordingly. This means that the user of the map is no longer the driver, but rather a machine. As a result, a new generation of maps built purposely for machines is needed. The next generation of maps comes in the form of a highly accurate and realistic representation of the road, generally referred to as high-definition (HD) maps.

As carmakers race towards an autonomous future, the industry as a whole widely agrees on the need for HD maps to make autonomous driving possible. TomTom is a pioneer in HD maps, having launched the first commercial HD map in 2015.

The TomTom HD Map is a highly accurate representation of the road, featuring a myriad of attributes including lane models, traffic signs, road furniture and lane geometry, with accuracy down to a few centimeters. The TomTom HD Map can be used to help an automated vehicle precisely localize itself on the road, to support the vehicle sensors to understand its surroundings, and to plan maneuvers. Because of these characteristics, the TomTom HD Map can be used to enable and improve different ADAS functions, such as Autopilot and Highway Pilot, all the way to Level 5 automation.

Figure 1[1]

92. Defendants created, generated and updated the Accused Products by deploying Mobile Mapping ("MoMa") vehicles throughout the world, including in the United States. Each of these vehicles were equipped with a series of 360° cameras and sensors that continuously captured digital images of the vehicle's surroundings in association with a global positioning system that associated the images with particular points on the globe. This fleet of Defendants' MoMa vehicles repeatedly traveled roadways to update its map data.

[1] *See* http://download.tomtom.com/open/banners/HD_Map_with_RoadDNA_Product_Info_Sheet.pdf

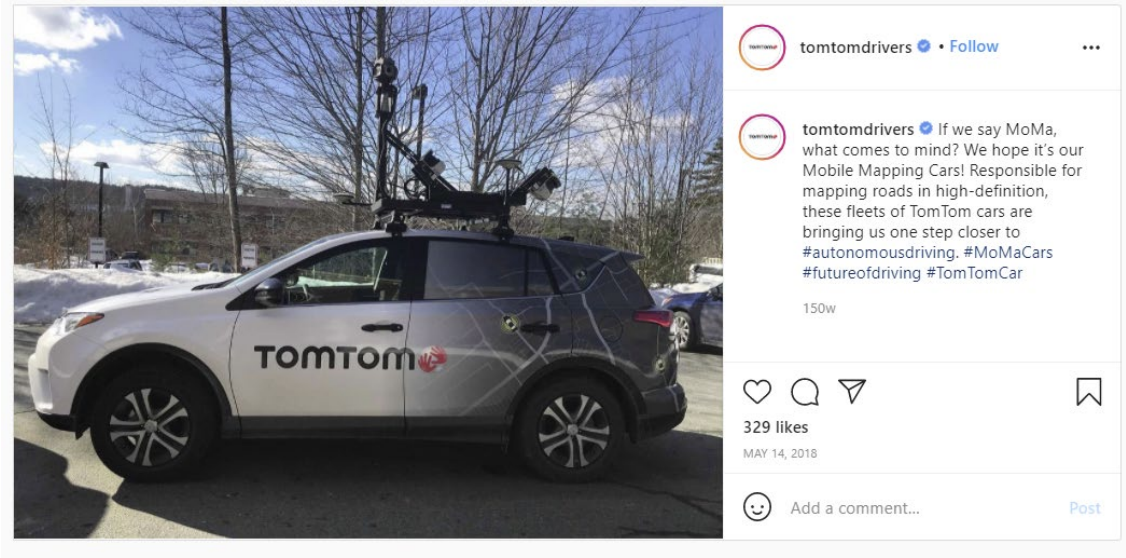


Figure 2[2]

Figure 3[3]

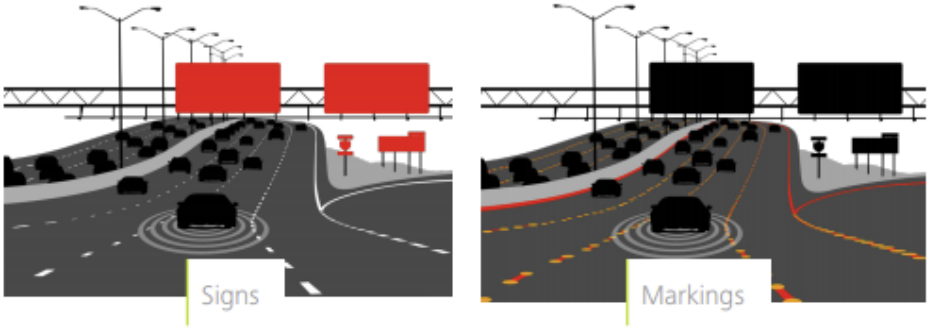
[2] *See* https://www.instagram.com/p/BiwwSTyglPv/?hl=en

[3] *See* https://twitter.com/TomTom/status/639561380840869889

93. Defendants used subject recognition software to continuously analyze this captured digital image data in order to automatically identify significant features that were critical for the Accused Products, for example, the existence and position of traffic signs and lane markings.

FEATURES	BENEFITS
Lane geometry	• Helps improve the lateral and longitudinal control in ADAS applications
Lane-level speed limits	• Helps improve the speed control function in ADAS applications
Lane markings	• Helps ensure the vehicle adheres to the traffic rules and for path planning
Traffic signs	• Helps ensure the vehicle adheres to the traffic rules
Road borders and guardrails	• Delivers improved driving scenarios
Lane connectivity	• Helps determine a safe and smooth path for the vehicle
Accuracy	• Allows neighboring reference locations in the HD Map to be positioned with an accuracy of 15-20 cm relative to each other
RoadDNA	• Helps achieve accurate localization across different sensor setups in a storage-friendly and processing-friendly format

Figure 4[4]



A collection of traffic signs along the road, mainly tailored for camera-based localization

A model of lane markings along the roadway, mainly tailored for camera-based localization

Figure 5[5]

94. Defendants also used subject-recognition software to ensure privacy protection for its products such that they could comply with privacy regulations. One example is automatic

[4] *See* http://download.tomtom.com/open/banners/HD_Map_with_RoadDNA_Product_Info_Sheet.pdf

[5] *Id.*

finding and "blurring" of faces in captured images prior to Defendants' distribution of those images to third-parties.

TomTom or its service partner blur elements in the imagery that could lead to recognition of individuals (such as faces and license plates) or apply other measures when permitted by local regulations to protect personal data before making it available to these third parties. TomTom uses secured data transfer methods to make the imagery available to contracted third parties upon their specific request. These third parties typically use the imagery for their own internal business purposes such as road construction or road maintenance.

Figure 6[6]

95. Upon information and belief, Defendants' subject recognition software infringed at least Claim 1 of the '317 Patent by employing a method for detecting a main subject in an image.

data extraction. Combining this know-how with our existing Artificial Intelligence expertise, we're extracting map data – such as road geometry, traffic signs and landmarks – from camera images. Capturing this type of data is particularly relevant in order to update the HD Map, to ensure it matches reality quickly. This will enable scalable and efficient updates to the TomTom HD Map on a continuous basis. By exploring and testing

Figure 7[7]

96. Defendants and their subject recognition software received a digital image from the MoMa vehicle's cameras and sensors.

[6] *See* https://www.tomtom.com/en_us/privacy/drive/

[7] *See* https://www.tomtom.com/automotive/automotive-solutions/automated-driving/hd-map-roaddna/

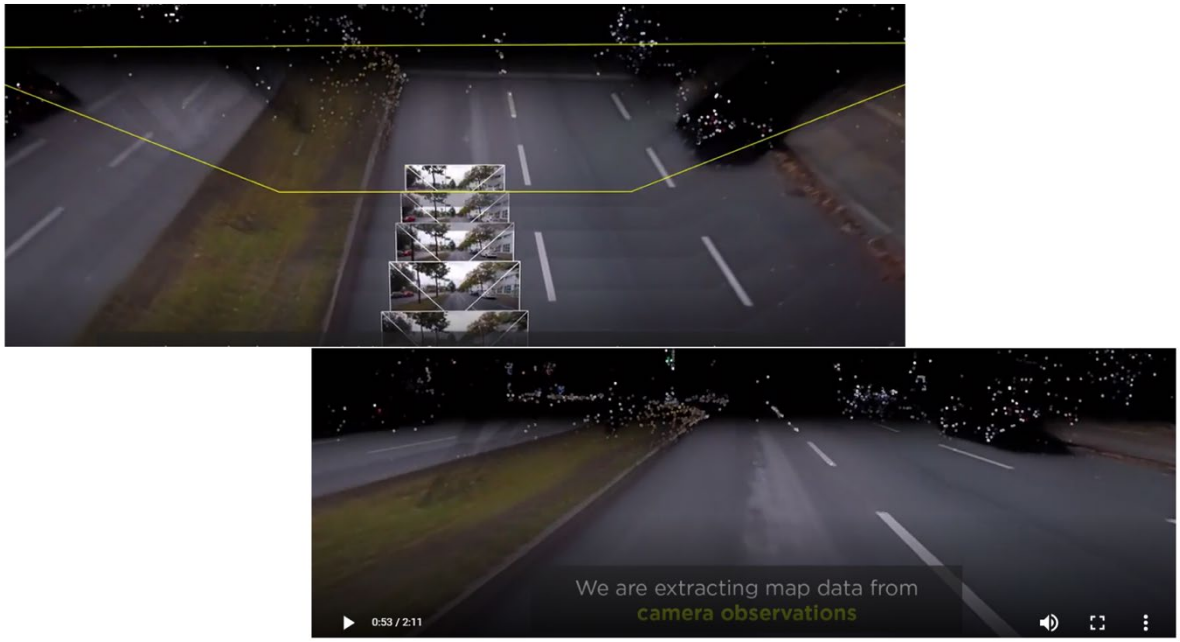


Figure 8[8]

97. Defendants' subject recognition software extracted regions of arbitrary shape and size defined by actual objects from the digital image.

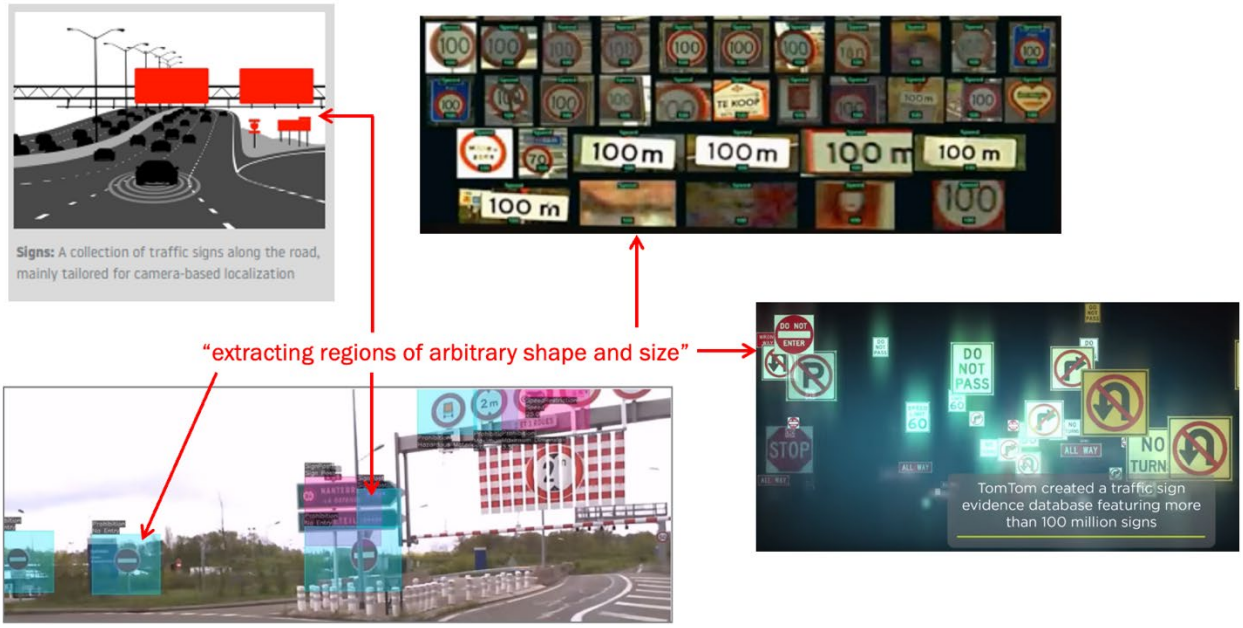


Figure 9[9]

[8] *See* https://www.youtube.com/watch?v=tkQoJZBPicw
[9] *Id.*

98. Defendants' subject recognition software extracted, for each region, a size, shape, location, and/or color (i.e. "structural saliency feature") and at least one attribute (lane markings, "warning", "traffic light", facial characteristics) relating to a subject ("semantic saliency feature").

99. Defendants' subject recognition software integrated the structural saliency feature and semantic feature using a probabilistic reasoning engine ("prediction" based) into an estimate of a belief that each region is the main subject.

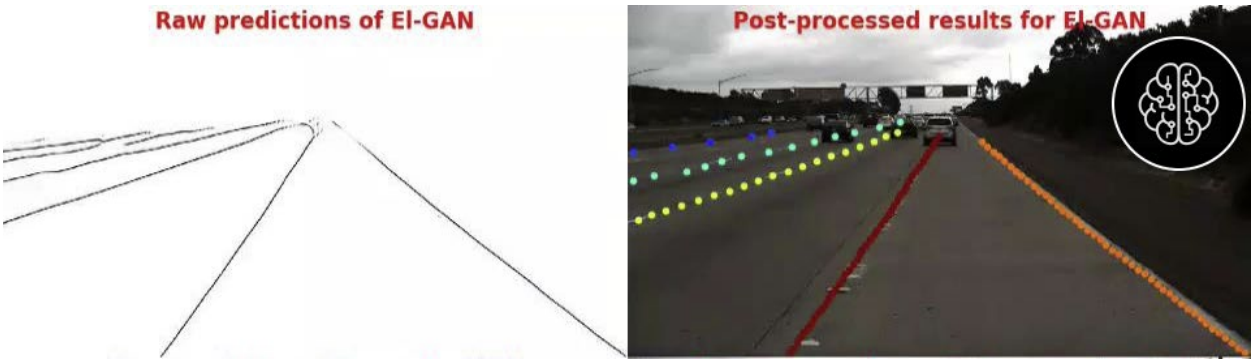


Figure 10[10]

[10] *See* https://on-demand.gputechconf.com/gtc/2018/presentation/s8700-unlocking-access-to-hd-maps-for-autonomous-driving.pdf

Our Contribution: Embedding Loss for Adversarial Training

The idea is to leverage the labels to steer the adversarial training and base the adversarial loss on high-level structures/characteristics of labels:

$$\mathcal{L}_{\text{gen}}(x, y; \theta_{\text{gen}}, \theta_{\text{disc}}) = \mathcal{L}_{\text{fit}}(G(x; \theta_{\text{gen}}), y) + \lambda \mathcal{L}_{\text{adv}}(G(x; \theta_{\text{gen}}), y; x, \theta_{\text{disc}}), \quad (3)$$

$$\mathcal{L}_{\text{adv}}(G(x; \theta_{\text{gen}}), y; x, \theta_{\text{disc}}) = \|D_e(y; x, \theta_{\text{disc}}) - D_e(\hat{y}; x, \theta_{\text{disc}})\|_2, \quad (4)$$

where D_e represents embeddings extracted from a certain layer in the discriminator network.

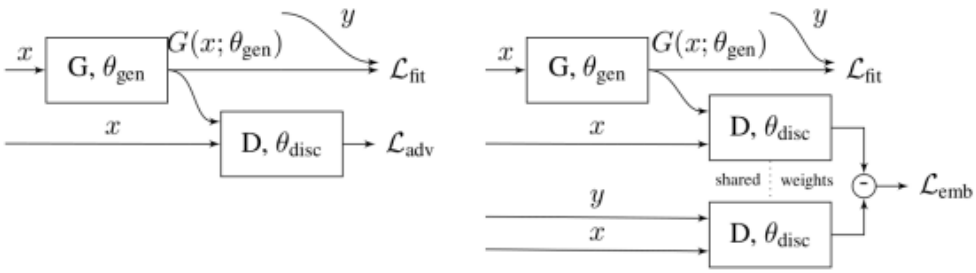


Figure: Illustration of the novel training set-up for the generator loss: left for a conventional GAN (Equations 1, 2), right when using the embedding loss (Equations 3, 4)

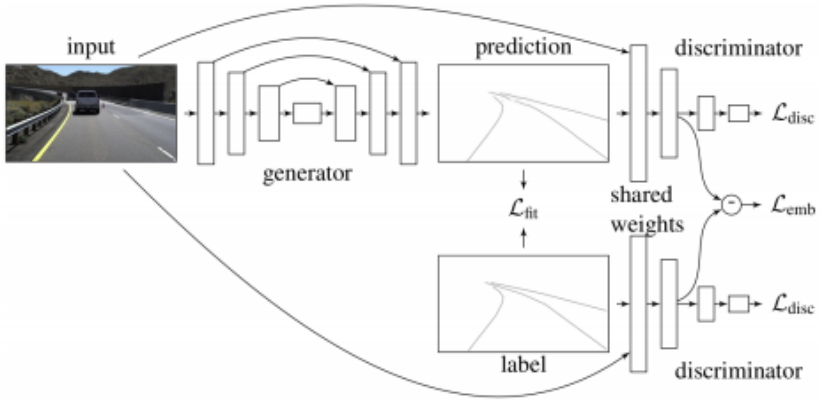


Figure: Schematic of EL-GAN architecture

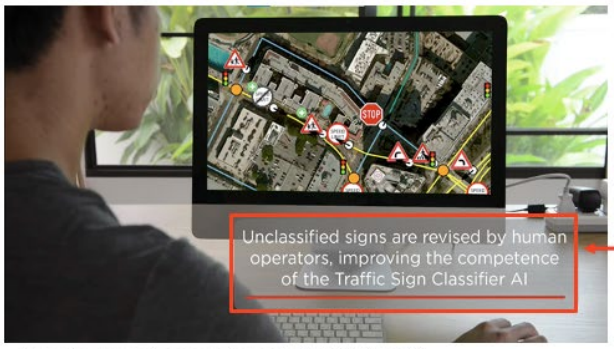
Figure 11[11]

[11] *See* http://mohsenghafoorian.nl/files/elgan_poster.pdf

In this work, we propose such an architecture for enforcing structure in semantic segmentation output. In particular, we propose EL-GAN ('Embedding loss GAN'), in which the discriminator takes as input the source data, a prediction map and a ground truth label, and is trained to minimize the difference between embeddings of the predictions and labels. The more useful gradient feedback and increased training stability in EL-GAN enables us to successfully train semantic segmentation networks using a GAN architecture. As a result, our segmentation predictions are structurally much more similar to the training labels without requiring additional problem-specific loss terms or post-processing steps. The benefits of our approach are illustrated in Fig. 1, in which we show an example training label and compare it to predictions of a regular segmentation network and our EL-GAN framework. Our contributions are:

Figure 8[12]

100. Defendants further performed the additional step of Claim 5 of the '317 patent by including a collection of opinions to train its reasoning engine to recognize the relative importance of saliency features. For example, Defendants employed human operators to revise unclassified signs (i.e. "human opinions") to improve the competence of its feature classification systems.



Human operators assist TomTom's Classifier AI in instances where images were unclassified, "improving the competence" (i.e., "train the reasoning engine") of the Classifier AI.

https://www.youtube.com/watch?v=tHzWQWsmke8

This AI tool allows TomTom to classify detected signs in an automated way with very high accuracy levels. Where needed, unclassified signs are revised by human operators, further improving the learning and competence of the Traffic Sign Classifier AI.

https://www.geoawesomeness.com/artificial-intelligence-set-accelerate-2017-predicitons-pieter-gillegot-vergauwen-vp-product-marketing-tomtom/

101. Defendants' Accused Products have been imported, sold and used within the United States without being materially changed by any subsequent process or becoming a trivial and nonessential component of another product.

[12] *See* https://download.tomtom.com/open/gpl/Embedding-Loss-Driven-GenerativeAdversarial-Networks-for-Lane-Detection.pdf

102. To the extent that Defendants have divided the performance of these steps among themselves, Defendant TomTom NA acted as an agent of TomTom International to infringe at least Claims 1 and 5 of the '317 Patent. Alternatively, the Defendants contracted with each other to perform the infringing steps. Alternatively, TomTom International conditioned TomTom NA's participation on the infringing activity, and it received benefits from performance of the infringing activity. TomTom International further established the timing and manner of the TomTom NA's performance of the infringing activity.

103. Alternatively, the Defendants formed a joint enterprise through their implied or express agreement, shared common purpose and pecuniary interest, and shared equal right of control and right to a voice in the performance of the infringing activity.

104. To the extent that Defendants have assigned performance of these steps to third parties, the third parties acted as agents of the Defendants to infringe at least Claims 1 and 5 of the '317 Patent. Alternatively, the Defendants contracted with the third parties to perform the infringing steps. Alternatively, the Defendants conditioned the third parties' participation and receipt of benefits on the performance on the infringing activity and further established the respective timing and manner of the third parties' performance of the infringing activity.

105. Defendants' infringing activities were without authority or license under the '317 Patent. Thus, Defendants have infringed at least Claims 1 and 5 of the '317 Patent under at least 35 U.S.C. § 271(a), (g) by their creation of, use, testing, manufacture, sale, offer for sale, licensing, and/or importation of the Accused Products, including use of TomTom's subject recognition software, without authority.

COUNT II: DIRECT INFRINGEMENT OF THE '461 PATENT

106. Plaintiff realleges and incorporates by reference the allegations set forth above, as if set forth verbatim herein.

107. MPV owns by assignment the entire right, title, and interest in the '461 Patent.

108. The '461 Patent was issued by the United States Patent and Trademark Office on April 25, 2006 and is titled "Method for Detecting Objects in Digital Images." A true and correct copy of the '461 Patent is attached as Exhibit B.

109. Upon information and belief, Defendants have directly infringed at least claims 1-3 and 15 of the '461 by making, using, testing (including their own use and testing), selling, offering for sale, importing and/or licensing in the United States without authority products, such as TomTom HD Maps, RoadDNA, and ADAS (collectively, "Accused Products") that are created, generated, manufactured, and updated in an exemplary infringing manner as described below.

110. Defendants' fleet of MoMa vehicles regularly travel throughout the world's roadways, including throughout the United States, capturing a variety of digital images. In order to manufacture, generate, and update the Accused Products, Defendants process these digital images using subject recognition software to detect certain objects, such as traffic signs, lane markings, and human faces.

data extraction. Combining this know-how with our existing Artificial Intelligence expertise, we're extracting map data – such as road geometry, traffic signs and landmarks – from camera images. Capturing this type of data is particularly relevant in order to update the HD Map, to ensure it matches reality quickly. This will enable scalable and efficient updates to the TomTom HD Map on a continuous basis. By exploring and testing

Figure 13[13]

111. Defendants' subject recognition software infringes Claim 1 of the '461 Patent by performing a method for detecting objects in a digital image, comprising the following steps:

112. Defendants' subject recognition software generates a first segmentation map of a digital image according to a non-object specific criterion, such as general environmental

[13] *See* https://www.tomtom.com/automotive/automotive-solutions/automated-driving/hd-map-roaddna/

characteristics.

113. Defendants' subject recognition software generates a second segmentation map of the digital image according to an object specific criterion, such as what a sign looks like and what makes it distinguishable from the background, such as color or reflectivity characteristics.

Let's take the example of traffic signs. To classify them, you would first need to show a machine learning algorithm many images with variations of traffic signs, from which it could learn a model for how each sign looks like and what makes it distinguishable. Once the algorithm would encounter a never-before seen image of a stop sign, it would be able to recognize it.

From the most common to the most unusual, all traffic signs should be labeled consistently and correctly in order to create accurate HD maps.

A similar approach is required to detect traffic signs. However, instead, you would need several images of road scenes with a rectangular box (or a mask) on top of each sign in order to teach the algorithm how a sign looks and where it usually is located in the environment.

This process extends to many other scenarios that are relevant to autonomous driving. One other example is labeling road geometry, such as signposts and road markings and integrating this information in our HD maps. Making accurate and consistent annotations is key to a map that knows every part of the road environment from every angle and condition.

Using AI is not only helping us achieve what would have otherwise been impossible in mapmaking but also accelerate the progress towards Level 5 autonomy. Let's look at four important reasons why AI is key to creating HD maps.

Figure 14[14]

114. Defendants' subject recognition software detects objects in the digital image using both the first and second segmentation maps.

[14] *See* https://www.tomtom.com/blog/autonomous-driving/how-we-make-our-hd-maps/

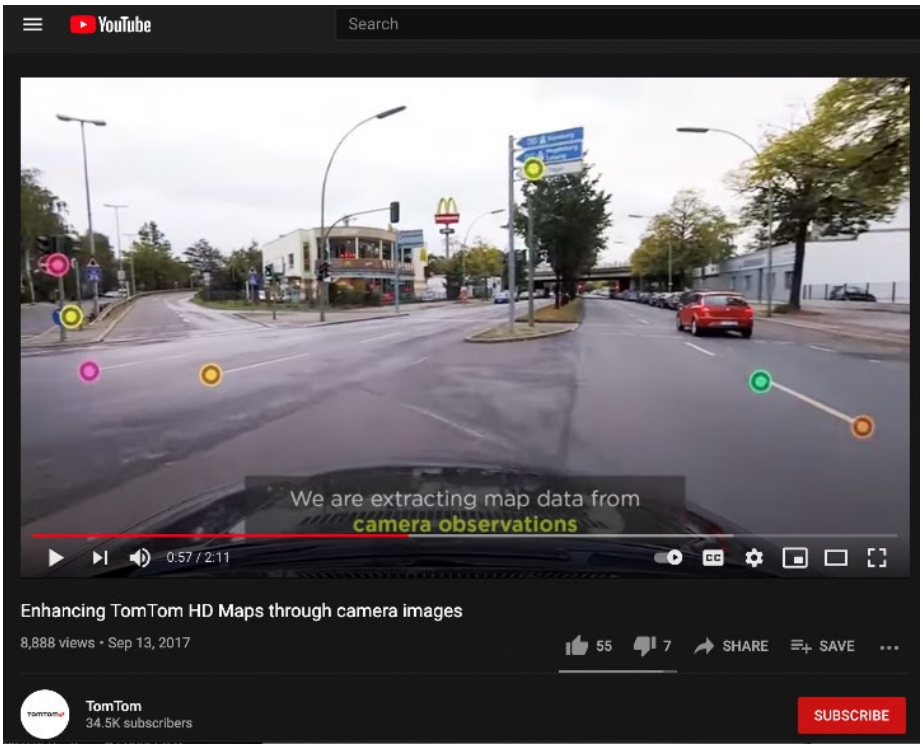


Figure 15[15]

115. Defendants' object detection software also infringes Claim 2 of the '461 Patent by merging the first and second segmentation maps prior to the detecting step and detecting the objects in the merged map using pattern matching.

116. Alternatively, Defendants' object detection software infringes Claim 3 of the '461 Patent by detecting objects using pattern matching in the first and second segmentation maps respectively and merging the detected objects.

117. Furthermore, upon information and belief, Defendants infringe Claim 15 of the '461 Patent by making, using, testing (including their own use and testing), selling, offering for sale, importing and/or licensing in the United States without authority a computer storage medium having instructions stored therein for causing a computer to perform the method of Claim 1.

[15] *See* https://www.youtube.com/watch?v=5YACo71cccA

118. Defendants' Accused Products have been imported, sold and used within the United States without being materially changed by any subsequent process or becoming a trivial and nonessential component of another product.

119. To the extent that Defendants have divided the performance of these steps among themselves, Defendants TomTom NA acts as an agent of TomTom International to infringe at least Claims 1-3 and 15 of the '461 Patent. Alternatively, the Defendants contract with each other to perform the infringing steps. Alternatively, TomTom International conditions TomTom NA's participation on the infringing activity, and it receives benefits from performance of the infringing activity. TomTom International further establishes the timing and manner of TomTom NA's respective performance of the infringing activity.

120. Alternatively, the Defendants form a joint enterprise through their implied or express agreement, shared common purpose and pecuniary interest, and shared equal right of control and right to a voice in the performance of the infringing activity.

121. To the extent that Defendants have assigned performance of these steps to third parties, the third parties act as agents of the Defendants to infringe at least Claims 1-3 and 15 of the '461 Patent. Alternatively, the Defendants contract with the third parties to perform the infringing steps. Alternatively, the Defendants condition the third parties' participation and receipt of benefits on the performance on the infringing activity and further establish the respective timing and manner of the third parties' performance of the infringing activity.

122. Defendants' infringing activities were without authority or license under the '461 Patent. Thus, Defendants have, and continue to infringe at least Claims 1-3 and 15 of the '461 Patent under at least 35 U.S.C. § 271(a) and (g) by their continued use, testing, manufacture, sale, offer for sale, licensing, and/or importation of the Accused Products without authority.

123. Defendants have also committed acts of infringement 35 U.S.C. § 271(f) by exporting all or a substantial portion of the components of the invention claimed in the ’461 Patent and actively inducing others to combine the components outside of the United States in a manner that would infringe at least Claim 15 of the ’461 Patent if the combination occurred in the United States.

COUNT III: INDIRECT INFRINGEMENT OF THE ’461 PATENT

124. Defendants’ users, customers, agents and/or other third parties (collectively “third party infringers”) infringe, including under 35 U.S.C. § 271(a), at least claim 1-3 and 15 of the ’461 Patent, while Defendants actively induced such infringement. Alternatively, or in addition, Defendants sold or offered to sell within the United States or imported into the United States a material or apparatus for use in practicing the patented process.

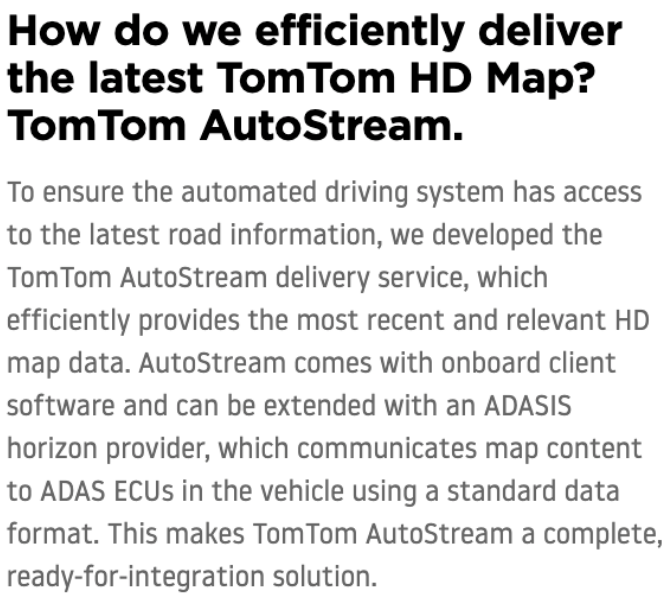


Figure 16[16]

[16] *See* https://www.tomtom.com/products/hd-map/

125. The third party infringers make, use, test, manufacture, sell, or offer for sale, products, such as vehicles and devices, that utilize both onboard image capture systems and the Accused Products for detecting objects in a digital image.

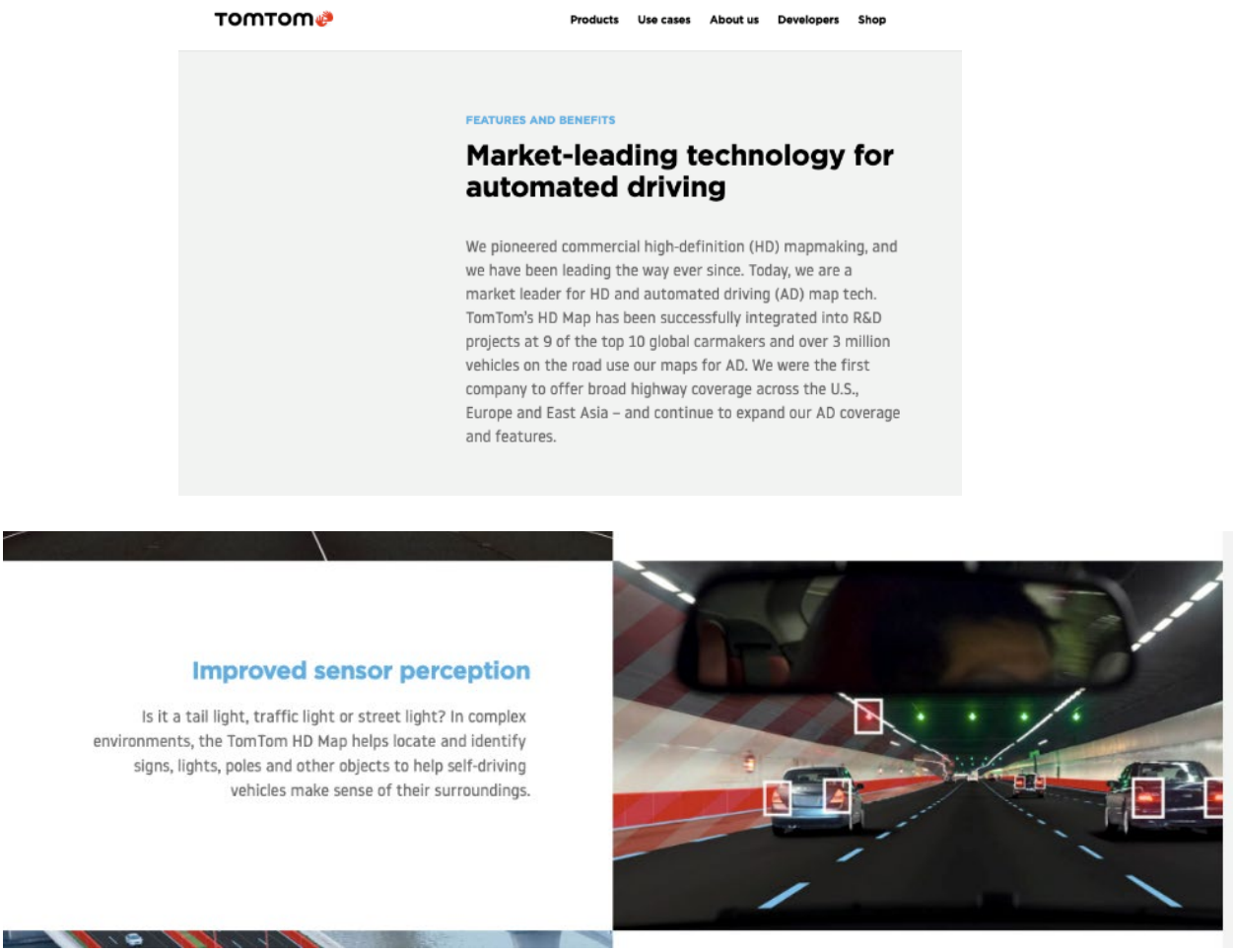


Figure 17[17]

126. With Defendants' active encouragement and/or using the Accused Products, the third party infringers generate a first segmentation map of the digital image captured using on-board sensors according to non-object specific criterion, such as color and position.

[17] *Id.*

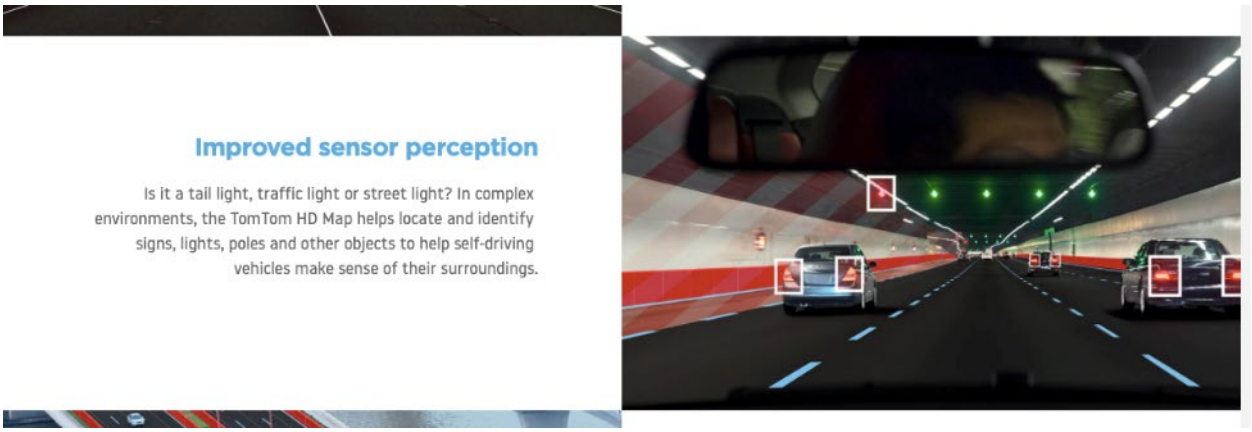
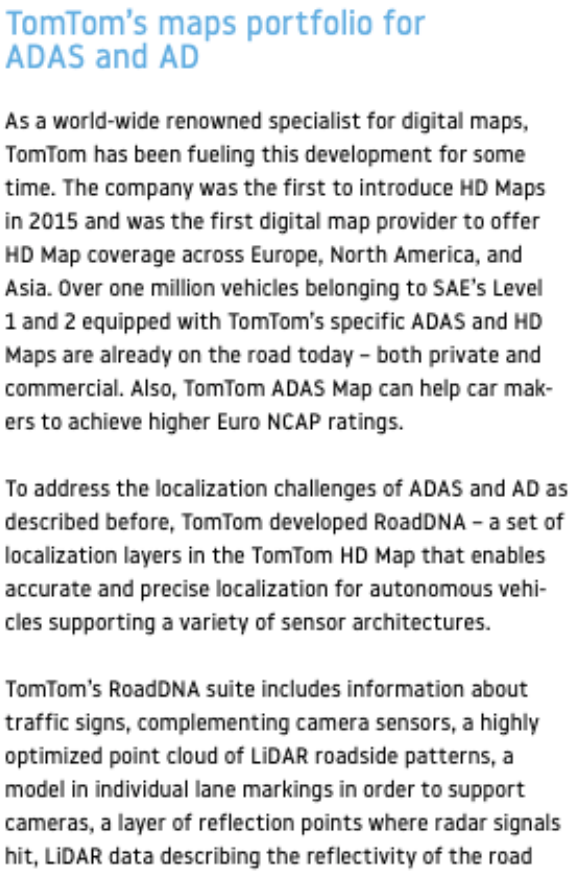


Figure 18[18]

127. With Defendants' active encouragement and/or using the Accused Products the third party infringers generate a second segmentation map of the digital image according to object specific criterion, such as the size, shape, position and/or color profile of a tail light, lane marking or traffic sign.

[18] *Id.*



TomTom's maps portfolio for ADAS and AD

As a world-wide renowned specialist for digital maps, TomTom has been fueling this development for some time. The company was the first to introduce HD Maps in 2015 and was the first digital map provider to offer HD Map coverage across Europe, North America, and Asia. Over one million vehicles belonging to SAE's Level 1 and 2 equipped with TomTom's specific ADAS and HD Maps are already on the road today – both private and commercial. Also, TomTom ADAS Map can help car makers to achieve higher Euro NCAP ratings.

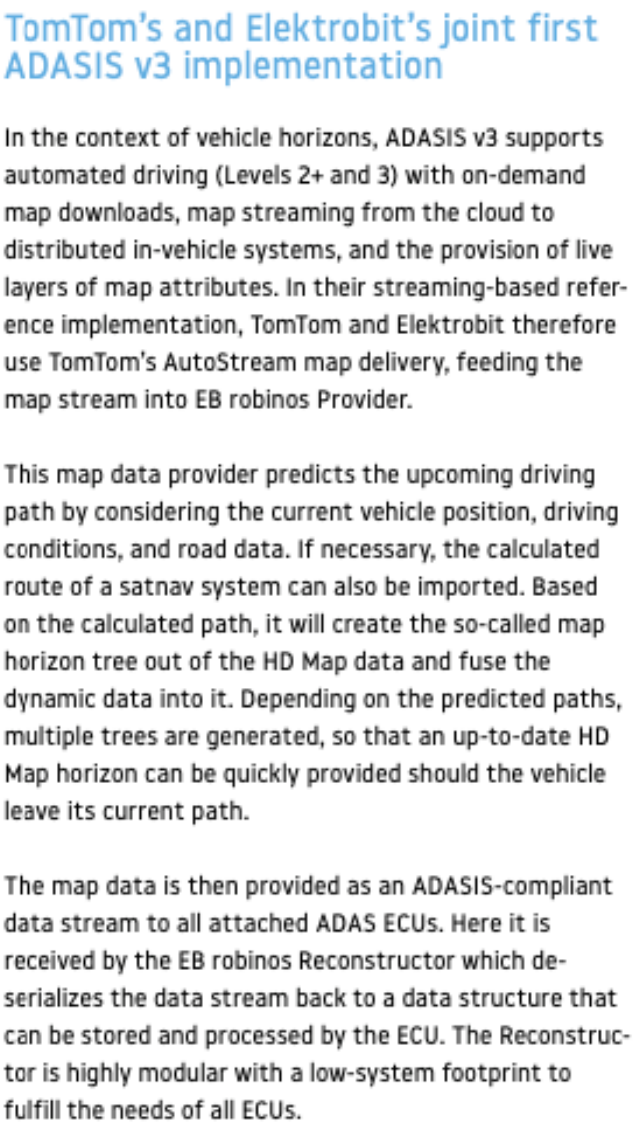
To address the localization challenges of ADAS and AD as described before, TomTom developed RoadDNA – a set of localization layers in the TomTom HD Map that enables accurate and precise localization for autonomous vehicles supporting a variety of sensor architectures.

TomTom's RoadDNA suite includes information about traffic signs, complementing camera sensors, a highly optimized point cloud of LiDAR roadside patterns, a model in individual lane markings in order to support cameras, a layer of reflection points where radar signals hit, LiDAR data describing the reflectivity of the road

Figure 19[19]

128. With Defendants' active encouragement and/or using the Accused Products, the third party infringers detect objects in the digital image using both the first and second segmentation maps.

[19] *See* https://download.tomtom.com/open/banners/Elektrobit_TomTom_white-paper.pdf



TomTom's and Elektrobit's joint first ADASIS v3 implementation

In the context of vehicle horizons, ADASIS v3 supports automated driving (Levels 2+ and 3) with on-demand map downloads, map streaming from the cloud to distributed in-vehicle systems, and the provision of live layers of map attributes. In their streaming-based reference implementation, TomTom and Elektrobit therefore use TomTom's AutoStream map delivery, feeding the map stream into EB robinos Provider.

This map data provider predicts the upcoming driving path by considering the current vehicle position, driving conditions, and road data. If necessary, the calculated route of a satnav system can also be imported. Based on the calculated path, it will create the so-called map horizon tree out of the HD Map data and fuse the dynamic data into it. Depending on the predicted paths, multiple trees are generated, so that an up-to-date HD Map horizon can be quickly provided should the vehicle leave its current path.

The map data is then provided as an ADASIS-compliant data stream to all attached ADAS ECUs. Here it is received by the EB robinos Reconstructor which de-serializes the data stream back to a data structure that can be stored and processed by the ECU. The Reconstructor is highly modular with a low-system footprint to fulfill the needs of all ECUs.

Figure 20[20]

129. With Defendants' active encouragement and/or using the Accused Products, the third party infringers further detect objects using pattern matching in the first and second segmentation maps respectively and merging the detected objects.

[20] *Id.*

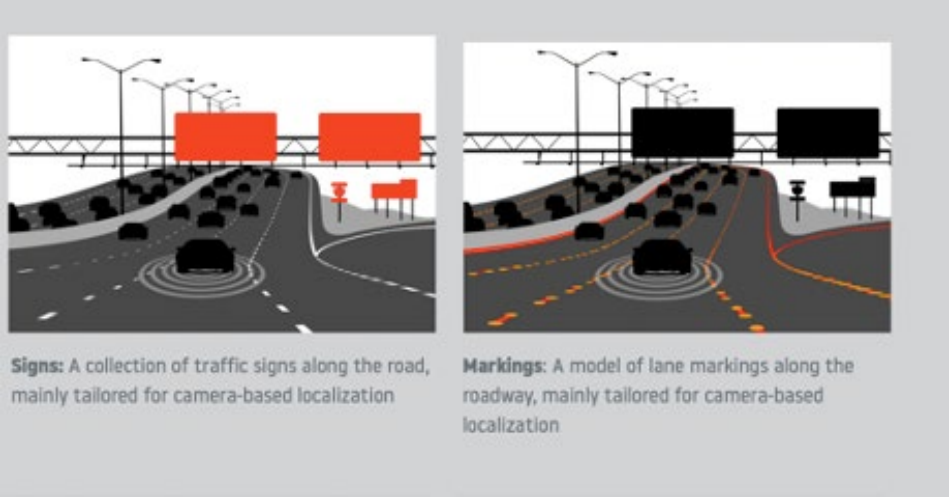


Figure 21[21]

Figure 22[22]

130. Upon information and belief, Defendants provide the third party infringers a computer storage medium especially adapted for use in infringement of at least Claim 1 and 3 the '461 Patent and not a staple article or commodity of commerce suitable for substantial non-infringing use. Defendants knew, or were willfully blind to the fact, that the Accused Products constituted a material part of the invention as claimed in at least Claim 1 and 3 of the '461 Patent and did not have a substantial non-infringing use.

[21] *See* https://download.tomtom.com/open/banners/HD-Map-with-RoadDNA-Product-Sheet.pdf

[22] *See* https://www.tomtom.com/products/hd-map/

131. Upon information and belief, Defendants had knowledge of the '461 Patent since at least May 2019 and encouraged and specifically intended third party infringement knowing, or with willful blindness to the fact, that the acts they induced constituted patent infringement.

132. Based on, among other things, the foregoing facts, Defendants induced and contributed to the infringement of Claims 1-3 and 15 of the '461 Patent under 35 U.S.C. § 271(b) and (c).

133. Defendants' acts of indirect infringement caused damage to MPV and MPV is entitled to recover from Defendants the damages sustained by Plaintiff as a result of Defendants' infringing acts in an amount subject to proof at trial, which, by law, cannot be less than a reasonable royalty, together with interest and costs as fixed by this Court, pursuant to 35 U.S.C. § 284.

COUNT IV: DIRECT INFRINGEMENT OF THE '320 PATENT

134. MPV realleges and incorporates by reference the allegations set forth above as if set forth verbatim herein.

135. MPV owns by assignment the entire right, title, and interest in the '320 Patent, including the right to sue for past infringement.

136. The '320 Patent was issued by the United States Patent and Trademark Office on December 28, 2010 and is titled "Classifying Image Regions Based on Picture Location." A true and correct copy of the '320 Patent is attached as Exhibit C.

137. Upon information and belief, Defendants have directly infringed and continue to directly infringe on at least Claim 1 of the '320 Patent by making, using, testing (including their own use and testing), selling, offering for sale, importing and/or licensing in the United States without authority products that utilize, created and/or are manufactured through infringing methods of classifying image regions, including but not limited to TomTom HD Maps, RoadDNA, ADAS, and AutoStream (collectively, "Accused Products."). Defendants offer, sell, import,

license and use these products by way of tangible, computer-readable media, such as SSD, DVD, or persistent computer memory.

138. Defendants infringe Claim 1 of the '320 Patent in the exemplary manners described below.

139. Defendants' fleet of MoMa vehicles regularly travel throughout the world's roadways, including throughout the United States, capturing a variety of digital images. In order to manufacture, generate, and update the Accused Products, Defendants processes these digital images using image region classification software to detect certain image regions, e.g., traffic signs, lane markers, road surface, and sidewalls, etc.

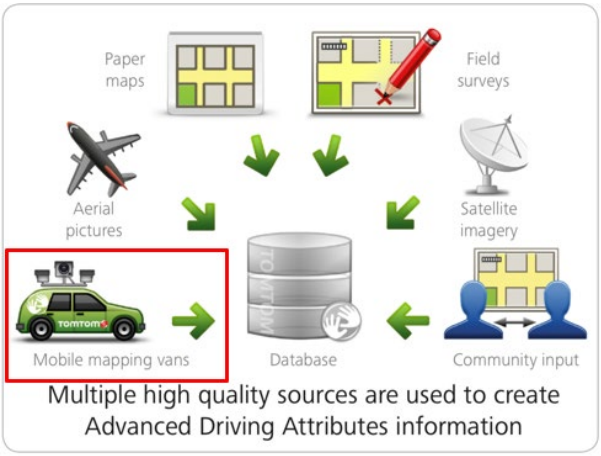


Figure 23[23]

140. Defendants' MoMa vehicles contain a geographic location determining device associated with the image capture device that provides an image capture GPS location associated with an image. *See* https://www.tomtom.com/en_us/privacy/drive/ ("To keep TomTom maps fresh, we collect information about these changes from various sources. One of these sources is the TomTom Mobile Mapping VANs. These vehicles are equipped with 360-degree cameras,

[23] *See* https://www.tomtom.com/lib/doc/licensing/I.ADA.EN.pdf

highly accurate GPS-receivers, and other sensor technologies to gather information.")

141. Defendants' MoMa vehicles use the location determining device to provide the image capture GPS location in real-time, i.e., at substantially the time that the digital image or video was captured. *See* http://download.tomtom.com/open/banners/RoadDNA-Product-Info-Sheet-1.pdf ("Through this, a vehicle can correlate RoadDNA data with data obtained by its own sensors. By performing this correlation in real-time, the vehicle's precise location on a road can be determined, even while travelling at high speeds.")

142. Defendants' software uses a data processor for classifying regions of image pixels in the captured digital image or video into one or more material classes (e.g., traffic signs, lane boundaries, lane dividers, curbs, guard rails, fences, walls) based on a spatial context model that indicates the likelihood that specific material classes occur or co-occur in images or videos captured at the particular image capture GPS location.

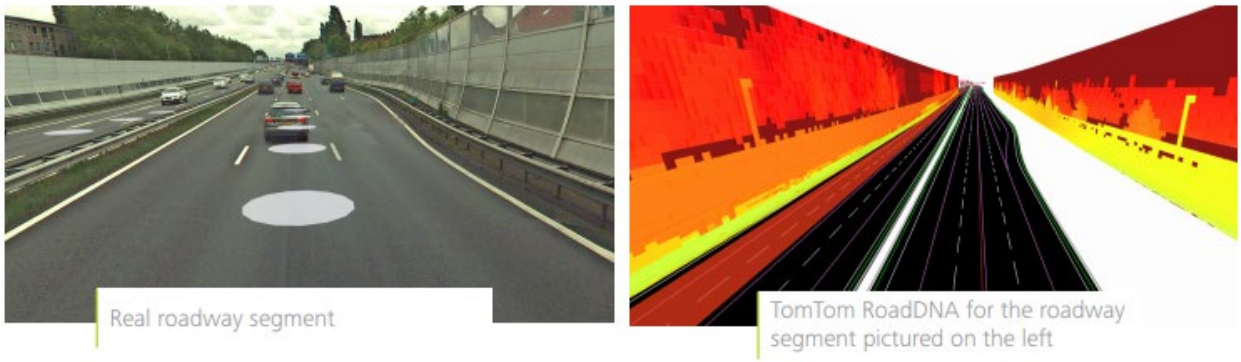


Figure 24[24]

[24] *See* https://wwwhttp://download.tomtom.com/products/hd-map/open/banners/RoadDNA-Product-Info-Sheet-1.pdf

Road model profile	Linear objects	Linear objects describe various kinds of real and virtual objects that can be represented by a line roughly in the direction of the lane: lane boundaries, lane markings, lane center lines, physical lane dividers, curbs, guard rails, fences, walls

Figure 25[25]

143. Defendants also manufacture, generate, and update the Accused Products by way of proof of concept vehicles (the "Concept Vehicles"). *See, e.g.*, https://www.tomtom.com/blog/autonomous-driving/crowdsourced-hd-maps/

144. Defendants' Concept Vehicles contain a geographic location determining device associated with the image capture device that provides an image capture GPS location associated with an image. *See*, *e.g.*, https://www.youtube.com/watch?v=C_IbEwB_Clk.

145. Defendants' Concept Vehicles use the location determining device to provide the image capture GPS location in real-time, i.e., at substantially the time that the digital image or video was captured. *See*, *e.g.*, *id*.

146. Defendants' Concept Vehicles use a data processor for classifying regions of image pixels in the captured digital image or video into one or more material classes (e.g., traffic signs, lane boundaries, lane dividers, curbs, guard rails, fences, walls) based on a spatial context model that indicates the likelihood that specific material classes occur or co-occur in images or videos captured at the particular image capture GPS location.

[25] *See* https://wwwhttp://download.tomtom.com/products/hd-map/open/banners/Elektrobit_TomTom_whitepaper.pdf

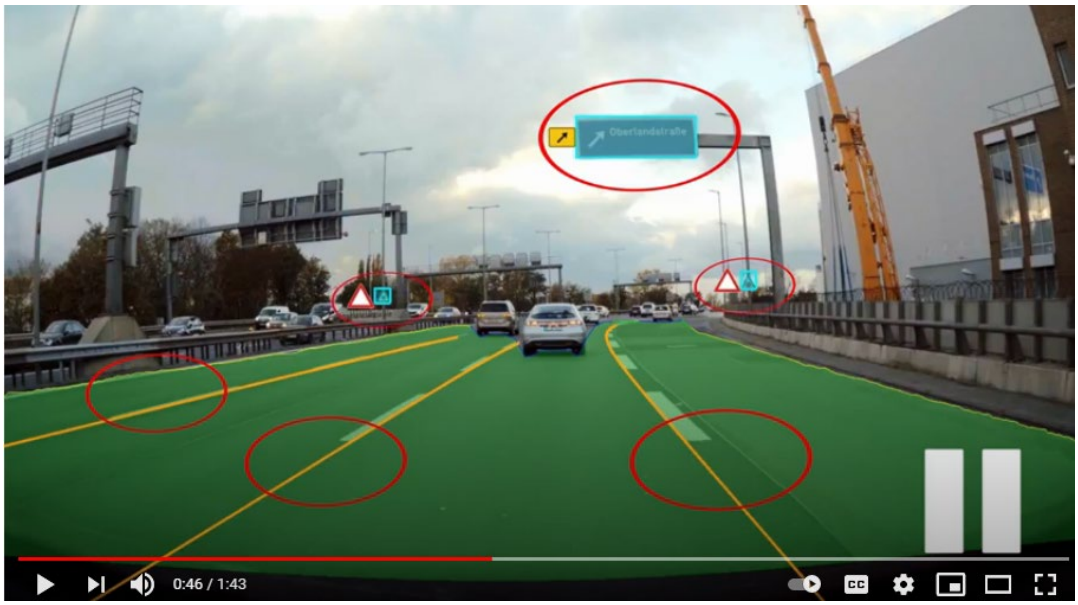


Figure 26[26]

147. Defendants' Accused Products have been imported, sold and used within the United States without being materially changed by any subsequent process or becoming a trivial and nonessential component of another product.

148. To the extent that Defendants have divided the performance of these steps among themselves, Defendants TomTom NA acts as an agent of TomTom International to infringe at least Claim 1 of the ’320 Patent. Alternatively, the Defendants contract with each other to perform the infringing steps. Alternatively, TomTom International conditions TomTom NA’s participation on the infringing activity, and its receives benefits from performance of the infringing activity. TomTom International further establishes the timing and manner of TomTom NA’s respective performance of the infringing activity.

149. Alternatively, the Defendants form a joint enterprise through their implied or express agreement, shared common purpose and pecuniary interest, and shared equal right of

[26] *See* https://download.tomtom.com/open/banners/Elektrobit_TomTom_white-paper.pdf; https://www.youtube.com/watch?v=C_IbEwB_Clk

control and right to a voice in the performance of the infringing activity.

150. To the extent that Defendants have assigned performance of these steps to third parties, the third parties act as agents of the Defendants to infringe at least Claim 1 of the '320 Patent. Alternatively, the Defendants contract with the third parties to perform the infringing steps. Alternatively, the Defendants condition the third parties' participation and receipt of benefits on the performance on the infringing activity and further establish the respective timing and manner of the third parties' performance of the infringing activity.

151. Defendants' infringing activities were without authority or license under the '320 Patent. Thus, Defendants have, and continue to infringe at least Claim 1 of the '320 Patent under at least 35 U.S.C. § 271(a), (g) by their continued use, testing, manufacture, sale, offer for sale, licensing, and/or importation of the Accused Products without authority.

COUNT V: DIRECT INFRINGEMENT OF THE '340 PATENT

152. MPV realleges and incorporates by reference the allegations set forth above as if set forth verbatim herein.

153. MPV owns by assignment the entire right, title, and interest in the '340 Patent, including the right to sue for past infringement.

154. The '340 Patent was issued by the United States Patent and Trademark Office on March 16, 2010 and is titled "Method of Using Temporal Context for Image Classification." A true and correct copy of the '340 Patent is attached as Exhibit D.

155. Upon information and belief, Defendants have directly infringed and continue to directly infringe on at least claim 1 of the '340 Patent by making, using, testing (including their own use and testing), selling, offering for sale, importing and/or licensing in the United States without authority products that utilize, created and/or are manufactured through infringing methods of classifying images or were generated by infringing methods of classifying images,

including but not limited to Defendants' autonomous driving products (collectively, "Accused Products."). Defendants offer, sell, import, license and use these products by way of tangible, computer-readable media, such as SSD, DVD, or persistent computer memory.

156. Defendants' image classification software infringes Claim 1 of the '340 Patent in an exemplary manner as described below.

157. Defendants improve scene classification on digital images taken by Defendants' MoMa vehicles and Concept Vehicles. *See, e.g.*, Figs. 24-26.

158. Cameras on the MoMa vehicles and Concept Vehicles provide a sequence of images captured in temporal succession, at least two pairs of consecutive images in the sequence of images having different elapsed times between their capture.

159. Defendants classify, with a programmed digital computer, each of the images individually based on information contained in the individual image to generate an initial content-based image classification for each of the images. Specifically, Defendants classify each captured image as having particular traffic signs or road geometry based on information contained in the individual image to generate an initial content-based image classification for each of the images. *See* https://www.youtube.com/watch?v=tHzWQWsmke8.

160. Defendants generate, with a programmed digital computer, a final image classification for each image based at least on the respective initial content-based image classification and a pre-determined temporal context model that considers at least the temporal succession of the sequence of images.

161. For example, if an image is initially classified as containing (or not containing) a certain traffic sign or road geometry; information from the other images in the sequence can verify the presence or absence of that particular traffic sign or road geometry.

162. As another example, Defendants advertise that "Roadagrams" (i.e., initial content-based image classifications of whether a certain image contains a particular traffic sign or road geometry) are sent to the TomTom Cloud to be "aligned and aggregated" for comparison to the current HD Map, i.e., processed by a pre-determined temporal context model that considers at least the temporal succession of the sequence of images. *See* https://www.youtube.com/watch?v=C_IbEwB_Clk.

163. Defendants store the final image classifications in a computer storage memory (i.e., "storage medium") by creating, e.g., TomTom HD Map updates.

164. Both the initial content-based image classification and the final image classification classify images into one of a predetermined number of classes M, where M is greater wherein M is greater than or equal to two.

165. Defendants' Accused Products have been imported, sold and used within the United States without being materially changed by any subsequent process or becoming a trivial and nonessential component of another product.

166. To the extent that Defendants have divided the performance of these steps among themselves, Defendants TomTom NA acts as an agent of TomTom International to infringe at least Claim 1 of the '340 Patent. Alternatively, the Defendants contract with each other to perform the infringing steps. Alternatively, TomTom International conditions TomTom NA's participation on the infringing activity, and they receive benefits from performance of the infringing activity. TomTom International further establishes the timing and manner of TomTom NA's respective performance of the infringing activity.

167. Alternatively, the Defendants form a joint enterprise through their implied or express agreement, shared common purpose and pecuniary interest, and shared equal right of

control and right to a voice in the performance of the infringing activity.

168. To the extent that Defendants have assigned performance of these steps to third parties, the third parties act as agents of the Defendants to infringe at least Claims 1 of the '340 Patent. Alternatively, the Defendants contract with the third parties to perform the infringing steps. Alternatively, the Defendants condition the third parties' participation and receipt of benefits on the performance on the infringing activity and further establish the respective timing and manner of the third parties' performance of the infringing activity.

169. Defendants' infringing activities were without authority or license under the '340 Patent. Thus, Defendants have, and continue to infringe at least Claims 1 of the '340 Patent under at least 35 U.S.C. § 271(a), (g) by their continued use, testing, manufacture, sale, offer for sale, licensing, and/or importation of the Accused Products without authority.

V.
WILLFUL INFRINGEMENT

170. Defendants' acts of infringement of the '461, '320, and '340 Patents have been willful and intentional under the standard of *Halo Elecs., Inc. v. Pulse Elecs., Inc.*, 136 S. Ct. 1923 (2016). Since at least June 2018, Defendants have had knowledge of, fully analyzed, and willfully infringed the '320 Patent by refusing to take a license and continuing the foregoing infringement. Since at least May 2019, Defendants have had knowledge of, fully analyzed, and willfuly infringed the '461 Patent by refusing to take a license and continuing the foregoing infringement. And since at least July 2019, Defendants have had knowledge of, fully analyzed, and willfuly infringed the '340 Patent by refusing to take a license and continuing the foregoing infringement.

VI.
JURY DEMAND

171. Plaintiff hereby demands a trial by jury of all issues so triable pursuant to Fed. R. Civ. P. 38.

VII.
PRAYER

For the reasons above, Plaintiffs respectfully requests that the Court find in its favor and against Defendants, and the Court grant Plaintiff the following relief:

a. An adjudication that Defendants have infringed the Asserted Patents, either literally and/or under the doctrine of equivalents;

c. An adjudication that the Defendants have induced infringement of the '461 Patent;

d. An adjudication that the Defendants have contributed to the infringement of the '461 Patent;

e. An adjudication that Defendants have, either literally or under the doctrine of equivalents, willfully infringed one or more claims of the '461 Patent;

f. An adjudication that Defendants have, either literally or under the doctrine of equivalents, willfully infringed one or more claims of the '320 Patent;

g. An adjudication that Defendants have, either literally or under the doctrine of equivalents, willfully infringed one or more claims of the '340 Patent;

h. A judgment that MPV be awarded damages adequate to compensate it for Defendants' past infringement of the Asserted Patents, and for any continuing and future infringements, including pre-judgment and post-judgment interest costs and disbursements as justified under 35 U.S.C. § 284 and an accounting;

i. That the Court declare this to be an exceptional case and award Plaintiff its reasonable attorneys' fees and expenses in accordance with 35 U.S.C. § 285; and

j. Any further relief that this Court deems just and proper.

Dated: April 19, 2021

Respectfully submitted,

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